Bundle for handling peripherally inserted central catheter in newborns

Bundle para manuseio do cateter central de inserção periférica em neonatos

Bundle para manipulación de catéter central de inserción periférica en neonatos

Maria Paula Custódio Silva[1]
Aline Guarato da Cunha Bragato[1]
Débora de Oliveira Ferreira[1]
Luana Barbosa Zago[2]
Silmara Elaine Malaguti Toffano[1]
Adriana Cristina Nicolussi[1]
Divanice Contim[1]
Jesislei Bonolo do Amaral[1]

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Descriptores
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Abstract
Objective: To build a bundle for prevention of primary infection of the bloodstream related to catheter that contemplates nursing care for handling the peripherally inserted central venous catheter in newborns.
Methods: Methodological research, developed in 2017 in three stages: bibliographic survey, instrument building and content validation by five judges. The instrument for validation was composed of 21 nursing care selected in the first stage. The Content Validity Index above 80% was used to assess concordance among the judges. This step was performed in a single round.
Results: Of the 21 items assessed by the judges, ten were excluded because they had a Content Validity Index under 0.80 and three were grouped to the other care listed. The final version of bundle was composed of eight items. The care included was related to hand hygiene before and after handling; use of syringes of proper caliber; exchange and disinfection of the stopcocks and connectors using alcohol 70%; and permeability test and care with dressing.
Conclusion: The study made it possible to create and validate among judges a bundle for handling peripherally inserted central catheter in newborns aiming to prevent primary infection of the bloodstream related to peripherally inserted central venous catheter.

Resumo
Objetivo: Construir um *bundle* para prevenção de infecção primária da corrente sanguínea relacionada a cateter que contemple cuidados de enfermagem para manuseio do cateter de acesso venoso central por inserção periférica em neonatos.
Métodos: Pesquisa metodológica, desenvolvida no ano de 2017 em três etapas: levantamento bibliográfico, construção do instrumento e validação de conteúdo por cinco juízes. O instrumento para validação foi composto por 21 cuidados de enfermagem selecionados na primeira etapa. O índice de validade de conteúdo acima de 80% foi utilizado para avaliar a concordância entre os juízes, esta etapa foi realizada em uma única rodada.
Resultados: Dos 21 itens avaliados pelos juízes, dez foram excluídos por apresentarem índice de validade de conteúdo menor que 0,80 e três foram agrupados ao demais cuidados elencados. A versão final do *bundle* foi composta por oito itens. Os cuidados incluídos foram relacionados a higienização das mãos antes e após as manuseio, o uso de seringas com calibre adequado, troca e desinfecção das dânulas e dos conectores com álcool 70%, teste de permeabilidade e cuidados com curativos.
Conclusão: O estudo permitiu elaborar e validar junto a juízes um *bundle* para manuseio do cateter central de inserção periférica em neonatos com vistas a redução de infecção primária da corrente sanguínea relacionada ao cateter de acesso venoso central por inserção periférica.

Resumen
Objetivo: Construir un *bundle* para la prevención de infección primaria del flujo sanguíneo relacionada con el catéter, que contemple cuidados de enfermería para la manipulación del catéter de acceso vascular central por inserción periférica en neonatos.
Métodos: Investigación metodológica, llevada a cabo en 2017 en tres etapas: análisis bibliográfico, construcción del instrumento y validación de contenido por cinco jueces. El instrumento para validación consistía en 21 cuidados de enfermería seleccionados en la primera etapa. El índice de validez del contenido superior a 80% fue utilizado para evaluar la concordancia entre los jueces, esta etapa se realizó en una única ronda.
Resultados: De los 21 ítems analizados por los jueces, 10 fueron excluidos por presentar índice de validez de contenido inferior a 0,80 y se agruparon otros 3 con los demás cuidados presentados. La versión final del *bundle* quedó compuesta por ocho ítems. Los cuidados que se incluyeron están relacionados con la higienización de las manos antes y después de la manipulación, el uso de jeringas de calibre adecuado, cambio y desinfección de llaves de tres vías y de conectores con alcohol 70%, prueba de permeabilidad y cuidados con los vendajes.
Conclusión: El estudio permitió elaborar y validar con jueces un *bundle* para la manipulación del catéter central de inserción periférica en neonatos con el objetivo de reducir la infección primaria del flujo sanguíneo relacionada con el catéter de acceso vascular central por inserción periférica.

Corresponding author
Jesislei Bonolo do Amaral
https://orcid.org/0000-0002-0591-7972
E-mail: jesisleimjlo@gmail.com

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[1]Universidade Federal do Triângulo Mineiro, Uberaba, MG, Brazil.
[2]Hospital de Clínicas, Universidade Federal do Triângulo Mineiro, Uberaba, MG, Brazil.
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Introduction

The incidence of Healthcare-Associated Infections (HAIs) and nosocomial bacteremia in newborns are directly related to birth weight, time of mechanical ventilation and use of Central Venous Catheter (CVC),[1] increasing the morbimortality rate, leading to prolonged hospitalization and increase of care costs.[2] The care in the Neonatal Intensive Care Unit (NICU) has better technology, however, it presents a greater number of invasive procedures and consequently of the HAIs. [3,4]

The Peripherally Inserted Central Venous Catheter (PICC) is widely used in newborns, due to advantages such as prolonged stay time, reduced puncture number, reduced risk of phlebitis, infiltration and extravasation.[5,6]

The insertion of the PICC is an activity of trained nurses and doctors.[5] In the current scenario, the nurse is responsible for training the nursing team regarding the recommendations for handling and maintenance of the device, as well as to identify early signs and symptoms associated with mechanical, thrombotic and infectious complications.[5,7]Even training the professionals, the development of protocols and guidelines are not sufficient to ensure adherence in practice of PICC care, evidenced by the high prevalence of Central Line-Associated Bloodstream Infection (CLABSI).[8,9]

One of the strategies to minimize the CLABSI and ensure patient safety is the systematization of care, since it reduce the variability in care.[10] The bundle is a set of specific care and, when used together, provide significant improvement in health care.[11-13] This is a light technology proposed by the Institute for Healthcare Improvement,[14] which has since been used to prevent various aggravations.[8,15-18] As protocols, guidelines and checklists, the bundles are tools developed by experts, based on best evidence for safer practice of health and its use provides reduction of adverse events.[19]

The factors considered in the selection of care included in the bundle are: costs, ease of implementation and adherence to these interventions. The success of implementation depends on that all the measures be carried out together, without excluding steps.[11] The use of this NICU strategy has been shown to be feasible in the prevention and reduction of CLABSI[14,20,21] and has been associated to the best time of stay of the PICC without complications.[14]

In order to encourage adherence to safe practices for improving quality of care and reduction of catheter-related infection, the objective of this study was to build a bundle for CLABSI prevention that includes nursing care for handling of the PICC in newborns.

Methods

Methodological research, developed in 2017 in three stages: bibliographic survey, instrument building and content validation by judges.

In order to identify the existing information in the national and international literature related to the subject, it was conducted a search for primary studies in the databases: National Library of Medicine, Virtual Health Library, Cumulative Index to Nursing and Allied Health Literature, Scopus Info Site, Cochrane and Web of Science. It was included studies of evidence level I, II and III, international, national and local protocols, published in the last five years, that addressed strategies to minimize the CLABSI.

The instrument for validation was built in standard HyperText Markup Language (HTML) as an online form, in the Google Drive. The first part of the instrument described the characteristics of experts such as age, professional training, work institution and time of practice regarding the theme. The second consisted of 21 items related to nursing care with the PICC in newborns, identified in the studies included in the bibliographic survey stage.

Each of the items had five choice options scored according to the Likert scale: strongly disagree, slightly disagree, agree, slightly agree, and strongly agree. This scale allows to analyze the agreement of opinions by an ordinal graduation of information where the number five represents maximum agreement and

the number one, minimum agreement.[22] A blank field has been enabled for comments or suggestions regarding semantic agreement for removal, addition and/or modification in each item.

The instrument was submitted to the apparent validation and of content regarding the adjustment of the attributes and the theoretical construction, by five judges of nursing area. The selection of judges was carried out by means of a convenience sample, based on the analysis of existing curriculum in the Brazilian National Council for Scientific and Technological Development (*CNPq - Conselho Nacional de Desenvolvimento Científico*) database. The selection criteria were established according to degree, specialization, scientific production, knowledge and time of practice regarding the addressed theme and/or assessment of instruments.

Participants selected as judges were contacted by electronic mail, by means of an invitation letter, which presented the objectives of the study and link of the Free and Informed Consent Form together with the instrument to be evaluated. Given the consent to participate by selecting a specific item, the expert had access to the instrument, and if he did not agree to participate, the process was finished. Eleven judges were invited to participate in the study, of which five accepted and returned to the assessment within the agreed 15-day period, four of them did not return on time and two refused. The validation was carried out in one round.

The data were stored in a database in Excel® format. It was used the double typing technique for later validation. Following were imported to the software Statistical Package for the Social Sciences (SPSS) version 21.0 and analyzed by means of descriptive statistic. The Content Validity Index (CVI) was used to evaluate the consensus of the experts regarding the representativeness of the care to be included in the instrument by the sum of the items: strongly agree, slightly agree and agree, divided by the total number of these. The consensus level agreed among the experts was 80%, as the literature recommends.[22,23]

The study was approved by the Research Ethics Committee of the *Universidade Federal do Triângulo Mineiro*, opinion nº 2,175,928, identifier CAAE 65534817.6.0000.5154 and met the ethical criteria of the recommendations of Resolution Nº 466/12.

Results

Regarding the five judges, all were nurses, with an average age of 40 years, three were nursing professors and two worked at NICUs.

Among the 21 items, related to nursing care for prevention of CLABSI in newborns that are using the PICC, assessed by the judges, were excluded the items 4, 11, 12, 13, 14, 16, 17 e 18 because they presented CVI lower than 0.80. The items 2, 8 and 21(Table 1) were grouped to the 1, 5 and 10 (Table 2) respectively, because they present continuity of nursing practice. The individual CVI was described in the table 1.

Table 1. Description of nursing care assessed by the judges

Items	Nursing Care	CVI
1	Perform hand hygiene for 40 to 60 seconds, before and after handling the catheter with antiseptic solution of chlorhexidine gluconate and/or 70% alcohol gel.	1
2	Use procedure glove to manipulate the stopcocks.	0.8
3	Use 10 and 20 ml syringes for medications.	1
4	Disinfect the connections, or lateral injector or hub before handling, with alcoholic chlorhexidine solution by means of the strict friction with at least five circular movements.	0.6
5	Disinfect the connections at each handling before they be accessed, with 70% alcohols second choice by means of the strict friction with at least five circular movements.	1
6	Change the stopcocks and connectors immediately when clots are present, and in 72h if they remain unchanged.	0.8
7	Perform the PICC permeability test before and after using it by injecting solution containing 0.9% of sodium chloride twice the minimum value of the priming of the catheter.	1
8	Apply the positive pressure technique or pulsatile flushing, before and after use to minimize the return of blood to the PICC lumen.	1
9	Perform newborn's bed bath that is with the PICC and avoid wetting the dressing.	1
10	Use aseptic technique to change the transparent and semipermeable sterile dressing over the insertion site.	1
11	Use sterile barrier precautions to change dressings.	0.4
12	Perform the first exchange of the sterile dressing with gauze in 48 hours.	0.6
13	Perform the first exchange of the sterile dressing with gauze in 24 hours.	0.6
14	Perform a dressing exchange every 7 days.	0.4
15	Perform the dressing exchange if dirt or at risk of detachment.	1
16	Use alcoholic antiseptic solution of chlorhexidine gluconate for insertion asepsis in the exchange of the sterile dressing regardless the weight of the newborn.	0.4
17	Use alcoholic antiseptic solution of chlorhexidine gluconate , in newborn over 1500g, for insertion asepsis in the exchange of the sterile dressing.	0.6
18	Use alcoholic antiseptic solution of chlorhexidine gluconate , in newborn under 1500g, for insertion asepsis in the exchange of the sterile dressing.	0.4
19	Perform inspection of the PICC completeness and its functioning daily and when there is an adverse event or technical complaint during intravenous therapy.	1
20	Evaluate the insertion site daily, at least at each shift.	1
21	Evaluate daily the need for catheter permanence.	1

CVI - Content Validity Index

Despite the items 10 and 21 show high concordance among judges, they were not included in this bundle because they need another investigation.

The final version of the bundle was composed by eight items after adjustment following judges' suggestions (Table 2).

Table 2. Nursing care included in the final version of the bundle

Items	Bundle for handling peripherally inserted central catheter in newborns
1	Perform hand hygiene for 40 to 60 seconds, before and after handling the PICC with antiseptic solution of chlorhexidine gluconate and/or 70% alcohol gel; use procedure gloves and take off adornments.
2	Perform inspection of the catheter completeness and its functioning daily and when there is an adverse event or technical complaint during medications infusion and serum therapy.
3	Disinfect the stopcocks and connections at each handling, with 70% alcohol by means of the strict friction with at least five circular movements.
4	Perform the access permeability test before and after using it by injecting solution containing 0.9% of sodium chloride twice the intern volume of the catheter, applying the positive pressure technique or pulsatile flushing.
5	Use 10 and 20 ml syringes for medications infusions and serum therapy.
6	Perform newborn's bed bath that is with the PICC and never wetting the dressing.
7	Perform the dressing exchange using aseptic technique, if dirt, at risk of detachment or humidity.
8	Change the stopcocks, connectors, extenders and devices immediately when clots are present or to administrate blood products; and each 72 to 96 hours if they remain unchanged, tagging the date when the device was changed.

Discussion

It was carried out a search of the main care to prevent CLABSI with the PICC in newborns during the handling. It was identified a lack of studies about this theme related to this specific population, being this, one of the limiting factors of the study.[9,24-27]

Adherence to the use of bundle has shown significant results in reducing CLABSI in NICU, linked to permanent education practices.[9,26] A meta-analysis aimed at evaluating the efficacy of bundles of CLABSI prevention in neonatal, pediatric and adult Intensive Care Unit, identified that this strategy implementation in different countries presents positive results in costs reduction.[28]

The first item selected to be part of the bundle was "Perform hand hygiene for 40 to 60 seconds, before and after handling the PICC with antiseptic solution of chlorhexidine gluconate and/or 70% alcohol gel; use procedure gloves and take off adornments." It is vital to emphasize that the use of procedure gloves does not replace hand hygiene. Being this a simple, low cost and essential measure in controlling CLABSI. However, there is a difficulty in approaching the health team when another professional does not perform this practice before insertion and manipulation of the PICC[18] It was included the term "remove adornments" (wedding rings, rings, bracelets, personal watches, necklaces, earrings, brooches, exposed piercings), to comply with the recommendations of regulation 32.[29] The use of adornments makes it difficult to properly clean the hands. If these adornments are not removed, residues of microbial cargo will be retained, making them vehicles for transmission of infection.[30]

Item 2 referred to the use of 10 and 20 ml syringes for medications infusions and serum therapy. Smaller syringes may cause pressure that can rupture the catheter or cause embolism. These gauges are recommended for higher safety.[24]

The third item included the disinfection of the stopcocks and connections at each handling, with 70% alcohol by means of the strict friction with at least five circular movements. Such care provides significant reductions in the CLABSI, however, there is no consensus on the use of 70% alcohol and the alcoholic antiseptic solution of chlorhexidine gluconate in neonatology.[23,25,26] In this study, the use of 70% alcohol had a better adhesion by the judges (CVI = 1).

The disinfection of the connections helps to prevent extraluminal colonization, reducing the chances of CLABSI, since it is a gateway to the infusion circuit.[9] The minimum number of five frictions established in this study meets the disinfection time of 15 to 30 seconds indicated in the literature.[9,24]

Regarding the exchange of the stopcocks and connectors, item 4 of the Bundle, it was followed the guidelines of The Brazilian Health Regulatory Agency (*ANVISA - Agência Nacional de Vigilância Sanitária*), with the recommendation to perform it immediately when there are clots present or after collection of blood or administration of blood products, and with interval less than 96 hours if they remain unchanged; confirming the recommendations of other studies. [16,25,27]

Item 5 includes the performance of the permeability test of the access before and after the use, to minimize the return of blood to the lumen of the

catheter, and avoid that there is precipitation between incompatible agents.[24] The volume recommended by the Infusion Nurses Society and ANVISA is at least twice the internal volume of the catheter plus twice the internal volume of the connections.[1,31]

Items 6 and 7 refer to the dressing. It is recommended to perform newborn's bed bath with the PICC, so that it does not get wet, dirty or loses its integrity, and the insertion site and connections must be protected with plastic.[1] In newborns it is not recommended to replace the dressing every seven days, but only if it is dirt, at risk of detachment or humidity.[23]

The item 8 is related to catheter integrity inspection and assessment of the insertion site and PICC permanence time. These are essential care to reduce and prevent CLABSI, as the infection rate increases for two weeks after insertion of the PICC and with permanence, associated to intra-luminal colonization and biofilm formation.[32]

Studies have been carried out to propose nursing care for prevention of the CLABSI in newborns that are using the PICC. Regarding the handling, the production is limited to a few studies, in that sense this study may give opportunities for new studies and some items can be explored with different methodologies.

The limitation of this study was to be specifically a validation. Other investigations are necessary to verify applicability of the items listed. However, this bundle is considered valid for the content and best level of evidence of care.

Conclusion

This study allowed to built and validate a bundle that includes nursing care for PICC handling in newborns, aiming at prevention of CLABSI based on better evidences. The included care was related to performing hand hygiene before and after handling using antiseptic solution of chlorhexidine gluconate and/or 70% alcohol gel; inspecting the integrity of the catheter and its functioning daily and when there is an adverse event or technical complaint during infusion; disinfecting the stopcocks and connectors with 70% alcohol; testing the permeability at each handling; using syringes of proper gauge; and do not wet and care for dressings and change stopcocks, connectors, extenders and device if clots are present and at pre-established intervals.

Collaborations

Silva MPC, Bragato AGC, Ferreira DO, Zago LB, Toffano SEM, Nicolussi AC, Contim D and Amaral JB declare that they contributed to the design of the project, analysis and interpretation of data, article writing, significant critical review of intellectual content and final approval of the version to be published.

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